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Chromosome numbers of Australian and New Guinean species of *Veronica* (Plantaginaceae)

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Abstract

New records of chromosome numbers are presented for eleven Australian species of *Veronica* sens. lat. Reference is also given to records previously published for ten species that have been referred to *Derwentia*, *Parahebe* or *Chionohebe*, but that are now included in a widely circumscribed *Veronica*. The species formerly included in *Derwentia*, *Parahebe* or *Chionohebe* exhibit secondary base numbers of $x = 21$, 20 or 19, whereas those formerly retained in *Veronica* have $x = 18$ (or 17). For the species formerly referred to *Detzneria*, from New Guinea, we present only a very approximate count of $2n = 38–42$ which, however, differs from the previous report of $2n = 48$.

Introduction

Differences in chromosome number have long been regarded as an important feature in characterising genera within Veroniceae (Frankel 1941, Frankel & Hair 1937, Garnock-Jones 1993). Chromosome numbers for most of the Australian and one New Guinean species are presented here (Table 1), making them available for a compilation of karyological data for Veroniceae (Albach et al. submitted). Information on the New Zealand taxa is given by Dawson (2000) while Bayly and Kellow (2006) provide a revised and updated list of chromosome numbers for species formerly included in *Hebe* or *Leonohebe*. New taxa and taxonomic notes on these Australian taxa are presented by Briggs and Ehrendorfer (2006) in this issue of *Telopea*. Chromosome numbers for most of the Australian species formerly included in *Derwentia* or *Parahebe* have been reported already by Briggs and Ehrendorfer (1992); references to these reports are included here, giving the names and authorities (as in Garnock-Jones et al. submitted), now that they will be included in an enlarged *Veronica*. For four species ('*V. arcuata*', '*V. blakelyi*', '*V. lithophila*' and '*V. tubata*'), as well as the subspecies of *V. derwentiana* and most of the Southern Hemisphere sections within *Veronica*, valid publication of the new combinations will await Garnock-Jones et al. (submitted).

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Methods

The new counts are mostly somatic numbers, determined on root-tip material, using 130 minutes of pre-fixation treatment with saturated aqueous *p*-dichlorobenzene and staining with alcoholic carmine (Snow 1963). Plants transplanted from the wild were grown at the Royal Botanic Gardens Sydney. In most cases, the number reported was counted from several cells. For '*V. tubata*', however, only a small amount of wild-collected stem and leaf meristematic tissue was available and only approximate counts were obtained. In that case, the chromosomal spreads (of several cells) were far from ideal but the result is included since it differed from what had been previously reported.

Results

The new findings and reference to previous reports are presented in Table 1. Voucher specimens and their collectors are cited.

Discussion

The findings are mostly consistent with previous reports (Briggs & Ehrendorfer 1992), in that the species formerly included in the genera *Derwentia* ('*V. arcuata*', *V. arenaria*, '*V. blakelyi*', *V. decorosa*, *V. derwentiana*, *V. nivea*, *V. perfoliata*, '*V. velutina*'), *Parahebe* ('*V. lithophila*'), *Chionohebe* (*V. densifolia*) and one previously of uncertain generic position (*V. formosa*) have numbers of $x = 19, 20$ or 21. These species are here referred to the *Derwentia* clade and the *V. formosa* clade within '*Veronica* sect. *Derwentia*' and the *Chionohebe* clade within sect. *Hebe* (Briggs & Ehrendorfer 2006, Garnock-Jones et al. submitted). By contrast, all records for the Australian species formerly retained in *Veronica* show secondary base numbers of $x = 17$ or 18 and are placed in the *V. calycina* clade of 'sect. *Derwentia*'. For *Veronica tubata*, the sole member of '*V.* sect. *Detzneria*', only a very approximate count of $2n = 38–42$ is reported, but it is a finding different from the previously reported count of $2n = 48$ (Borgmann 1964).

Wagstaff et al. (2002) showed that, from analysis of ITS DNA data, '*Veronica lithophila*' (then known as *Parahebe lithophila*) grouped more closely with species of *Derwentia* than with *V. calycina* or with the New Zealand species then placed in *Parahebe* and that are now referred to *Veronica* sect. *Hebe*. The chromosome number $2n = 42$ does not assist in resolving its subgeneric position, but supports its placement in the *Derwentia* clade, rather than the *V. calycina* clade, within *Veronica* 'sect. *Derwentia*'. We take this opportunity to correct a previous error concerning *V. lithophila*. Garnock-Jones has drawn attention to the folded lateral corolla lobes of *Parahebe* as a distinguishing feature of the genus. When describing this species (Briggs & Ehrendorfer 1992) we included a photo supposedly illustrating this feature in newly-opened flowers of *P. lithophila* and we considered this feature to be among those identifying it as a species of *Parahebe*. We were later advised that the photo was not of this species, as we had understood, but of cultivated plants of a New Zealand species. *Veronica lithophila* has flat lateral corolla lobes, as in *Derwentia* species.

In agreement with Albach et al. (submitted), we hypothesise that the chromosome numbers of the Southern Hemisphere *Veronica* species of sect. '*Derwentia*' and sect. *Hebe* have been derived from $x = 8$, characteristic for the most closely related Northern Hemisphere *V.* subgenus *Chamaedrys*. If the previous record of $2n = 48$ for the monospecific *V.* 'sect. *Detzneria*' (formerly *Detzneria tubata*) in New Guinea is correct, the secondary hexaploid base number $x = 24$, is still maintained. Our finding, of $2n = 38–42$ for this species, however, although only approximate, suggests that dysploid change ($x = 8 \rightarrow 7$) may have preceded polyploidy or that only dysploid levels may now exist. From the hexaploid level, stepwise descending dysploidy could have resulted in $x = 21 \rightarrow 20 \rightarrow 19 \rightarrow 18 \rightarrow 17$, the secondary base numbers found in the remaining Southern Hemisphere sections of *Veronica*. The evolutionary history may, however, be somewhat more complex since a number of reports deviate from multiples of these base numbers. Also, Bayly and Kellow (2006) observe that polyploidy is found 'within at least some species [of the New Zealand species of *V.* sect. *Hebe* and] it seems likely that independent origins of polyploidy have been relatively common'.

The patterns of different chromosome numbers tend to be obscured by inclusion of all these clades in an enlarged *Veronica*, but the previous classification was untenable if only monophyletic groups are to be recognised, as discussed by Garnock-Jones et al. (submitted).

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Table 1. Chromosome numbers reported for Australian and a New Guinean species of *Veronica*, new findings and reference to previous records. Combinations at sectional, species and subspecies rank indicated as 'ined.' will be published in Garnock-Jones et al. (submitted).

Taxon	*n*	2*n*	Voucher (Herb. NSW)	Collector	Locality or reference
'*Veronica* sect. *Derwentia* (Raf.) B.G.Briggs' ined.					
***V. calycina* clade**					
Veronica brownii Roem. & Schult.		72	118260	*B. Briggs*	Blackheath Glen, NSW
Veronica calycina R.Br.		36	84539	*L. Johnson & B. Briggs 1058*	near Mt Werong, NSW
Veronica distans R.Br.		72	95339	*F. Ehrendorfer 17601*	Hamelin Bay, WA
Veronica gracilis R.Br.		c. 72	97476	*R. Coveny 903*	Wingecarribee Swamp, NSW
Veronica grosseserrata B.G.Briggs & Ehrend.		72	95319	*R. Coveny*	Gloucester Tops, NSW
		72	95276	*A. Rodd 380*	Mountain Creek, Vic.
Veronica hillebrandii F.Muell.		36	101772	*A. Rodd*	cultivated ex South Australia
Veronica notabilis F.Muell. ex Benth.		36	255756	*B. Briggs 3989*	Brown Mountain, NSW
Veronica plebeia R.Br.		34	240439	*F. Ehrendorfer 18301*	Porongorup Mts, WA
		34	118263	*B. Briggs*	Megalong Valley, NSW
		34	95314	*R. Coveny*	Copeland, NSW
Veronica sobolifera B.G.Briggs & Ehrend.		72	98196	*R. Coveny*	Gloucester Tops, NSW
Veronica subtilis B.G.Briggs & Ehrend.		36	95757	*B. Briggs 1082*	Tomat Swamp, NSW
***Derwentia* clade**					
'Veronica arcuata (B.G.Briggs & Ehrend.) B.G.Briggs' ined.		42	96611	*J. Williams*	Bullock Creek, E of Armidale, NSW
Veronica arenaria A. Cunn. ex Benth.	19	38	95685	*F. Ehrendorfer et al.*	Briggs & Ehrendorfer (1992), as *Derwentia arenaria*
'Veronica blakelyi (B.G.Briggs & Ehrend.) B.G.Briggs' ined.		42	101598	*B. Briggs 1058*	Clarence, NSW
Veronica decorosa F.Muell.	19	38	97485	*Hj. Eichler*	Briggs & Ehrendorfer (1992), as *D. decorosa*

Taxon	*n*	2*n*	Voucher (Herb. NSW)	Collector	Locality or reference
Veronica derwentiana, subsp. not recorded, probably subsp. *derwentiana*	20			*O. Frankel*	Briggs & Ehrendorfer (1992), as *D. derwentiana*
'*Veronica derwentiana* subsp. *homalodonta* (B.G.Briggs & Ehrend.) B.G.Briggs' ined.		40	118325	*McArthur*	Briggs & Ehrendorfer (1992), as *D. derwentiana* subsp. *homalodonta*
'*Veronica derwentiana* subsp. *subglauca* (B.G.Briggs & Ehrend.) B.G.Briggs' ined.		40	101605	*B. Briggs 1011 & L. Johnson*	Briggs & Ehrendorfer (1992), as *D. derwentiana* subsp. *subglauca*
'*Veronica lithophila* (B.G.Briggs & Ehrendorfer) B.G.Briggs' ined.		42 42	84562 98192	*B. Briggs 1125* *A. Rodd 517*	Briggs & Ehrendorfer (1992), as *Parahebe lithophila*
Veronica nivea Lindl.		40		*F. Ehrendorfer*	Briggs & Ehrendorfer (1992), as *D. nivea*
Veronica perfoliata R.Br.	20	40	854491	*L. Johnson*	Briggs & Ehrendorfer (1992), as *D. perfoliata*
'*Veronica velutina* (B.G.Briggs & Ehrend.) B.G.Briggs' ined.		40†	258899	*B. Briggs 4298 & L. Johnson*	Mt Kaputar plateau, NSW
V. formosa clade					
Veronica formosa R.Br.	21	42 42		*O. Frankel* *M. Phillips*	Briggs & Ehrendorfer (1992)
Veronica sect. _Hebe_ (Juss.) G.Don					
Chionohebe clade					
Veronica densifolia (F.Muell.) F.Muell.		42†	124420	*B. Briggs 2631*	Mt Northcote, NSW
'_Veronica_ sect. _Detzneria_' (Schltr. ex Diels) Albach ined.					
'*Veronica tubata* (Diels) Albach'ined.		38–42 48	249793	*B. Briggs 3747*	Mt Wilhelm, Papua New Guinea Borgmann (1964)

† Chromosome numbers that were reported by Briggs & Ehrendorfer (1992), but without citation of the voucher specimen.

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